

SPEED-CONTROLLED EXERCISE METHOD AND APPARATUS

This application claims priority based on U.S. provisional application Serial No. 60/018,755 filed May 31, 1996 which is incorporated herein by reference.

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The present invention relates to an apparatus for performing exercise and a method for using such apparatus and in particular to an apparatus which closely simulates many natural forms of exercise such as cross-country skiing, walking, running, biking, climbing and the like.

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BACKGROUND INFORMATION

Many forms of natural exercise (i.e., exercise performed without the use of a stationary exercise machine) provide numerous benefits to an exerciser. In a number of types of natural exercise, a bilateral motion is performed of such a nature that as muscle groups on one side of the body are used, e.g., to attain forward motion in a motive type of exercise, there is simultaneously some amount of resistance to muscle groups on the other side of the body, typically opposing types of muscle groups, so that both extension and flexion muscle groups are exercised. In a typical bilateral exercise such as cross-country skiing, the exerciser utilizes, e.g., gluteus maximus and hamstring muscles in the backward stroke and, simultaneously, on the opposite side, quadriceps and hip flexor muscles in the forward stroke. Cross-country skiing is one example of such an exercise. During cross-country skiing, while there is some resistance between the ski and the snow when sliding in either the forward or rearward direction, there is much greater resistance to sliding in the rearward direction. Thus in cross-country skiing, when a user pushes backward with the trailing, e.g., left foot, sliding forward with the opposite, right, foot, both sides of the body meet some amount of sliding resistance, although resistance to movement of the rearward direction is much greater.

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Although various attempts have been made to simulate cross-country ski exercise or other bilateral exercise on a stationary exercise machine, these attempts have not been fully successful in reproducing the experience with sufficient accuracy to provide many of the health benefits of natural exercise. For example, in some ski-type exercise devices, while the trailing limb encounters resistance, the opposite limb encounters virtually no resistance (typically only resistance from friction of moving machine parts). As a result, many such previous devices include a feature intended to counteract the force of the backward thrusting limb, such as an abdomen pad which receives the forward thrust of the exerciser's body as the exerciser pushes backward against resistance with each leg in an alternating fashion. It is believed that in such machines, pushing against the abdominal pad can lead to lower back stress and fatigue and detracts from an accurate simulation of the natural cross-country ski exercise. It is further believed that the lack of forward resistance and the associated lack of balance in such devices leads to a

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long learning curve such that, to successfully use the machine, a user must develop a new technique for walking or skiing which is very different from that found in nature.

Another feature of many natural bilateral exercises such as skiing, walking, running, jogging, bicycle riding, etc., is that, while the exerciser may, on the average, move forward, the velocity of the user oscillates. Typically, an exerciser accelerates, e.g., while pushing backward with one leg, decelerates, momentarily accelerates again when pushing backward with the opposite leg, decelerates again, and so forth. As a result, in many natural bilateral exercises, although the exerciser maintains a constant average speed, in fact if one were to travel alongside the exerciser at such constant speed, the exerciser would appear to be oscillating forward and backward with respect to the observer. This constant change in acceleration is natural to most forms of human propulsion involving an alternating stride such as walking, running, bicycling, etc.

Again, it is believed that many exercise devices fail to reproduce this feature of the natural exercise with sufficient accuracy to provide an enjoyable exercise experience and to provide all the benefits available with natural exercise. Such as a more natural and less stressful distribution of force on the joints and development of good balance. For example, with the above-described ski exercise machine, the exerciser is typically pushing against the abdominal pad during substantially most or all of the exercise, thus causing the exerciser to stay in substantially the same position rather than accelerate and decelerate in an oscillating manner as in natural skiing exercise.

A number of forms of natural exercise provide exercise benefits to the upper body as well as the lower body of the exerciser. For example, in cross-country skiing, the exerciser typically pushes using poles. A number of features of the upper body exercise in natural exercise settings are of interest in the context of the present invention. For example, during cross-country skiing, the arm and leg motions are related such that, if a skier is maintaining a constant average speed, exerting greater upper body effort ("poling" with the arms) results in less effort being exerted by the legs, and vice versa. Further, in cross-country skiing, although the arm and leg energy exertions are related, the left and right upper body exertions are independent in the sense that the user does not need to pole in an alternating fashion, much less fashion which is necessarily synchronized with the leg motions. A cross-country skier may "double pole", i.e., pushing with both poles at the same time, or may, if desired, push with only a single pole or no poles for a period of time. Another feature of cross-country skiing is that, while the skier is moving, when a pole is plunged into the snow, the pole engages a resistance medium which, relative to the skier, is already in motion, thus providing a what may be termed "kinetic resistance".

Many types of previous exercise devices have failed to provide a completely satisfactory simulation of natural upper body exercise. For example, many previous ski devices provided only for dependent arm motion,

i.e., such that the arms were essentially grasping opposite ends of the rope wound around a spindle. In such devices, as the left arm moved backward, the right arm was required to simultaneously move forward substantially the same amount. Thus it was impossible to accurately simulate double poling or poling with a single arm. Many previous devices provided upper body resistance that was entirely unrelated to lower body resistance. In such devices, if an exerciser was expending a given level of effort, by exerting greater upper body efforts, the user was not, thereby, permitted to correspondingly decrease lower body exercise while maintaining the same overall level of effort. Many previous devices having upper body resistance mechanisms provided what may be termed "static resistance" such that when the arm motion began, such as by thrusting or pushing, or pulling backward with one arm, the resistance device was being started up from a stopped position, typically making it necessary to overcome a coefficient of static friction and detracting from the type of kinetic or dynamic resistance experienced in the natural cross-country ski exercise.

Many types of exercise devices establish a speed or otherwise establish a level of user effort in such a fashion that the user must manually make an adjustment or operate a control in order to change the level of effort. Even when an exercise device has a microprocessor or other apparatus for automatically changing levels of effort, these changes are pre-programmed and the user cannot change the level of effort to a level different from the pre-programmed scheme without manually making an adjustment or providing an input or control during the exercise. For example, often a treadmill-style exercise machine is configured to operate at a predetermined speed or series of pre-programmed speeds, such that when the user wishes to depart from his or her predetermined speed or series of speeds, the user must make an adjustment or provide other input. In contrast, during natural exercise such as running, the user may speed up, slow down, or rest at will.

Accordingly, it would be useful to provide an exercise device and method which provides a more natural exercise feel, more closely simulates a variety of different natural exercises such as skiing, walking, running, bicycling, etc., exercises both extension and flexion muscle groups, provides for automatic and/or hands-free adjustment in a reaction to the level of user effort, and in general provides for safe, effective and enjoyable exercise experiences on a stationary exercise device.

SUMMARY OF THE INVENTION

The present invention involves an apparatus and a method for exercise which closely simulates a number of aspects of natural exercise. The invention can be used for simulating many types of exercise including, in various embodiments, simulating cross-country skiing, walking, running, bicycling, climbing and the like. The invention can include, in various combinations, any or all of a one-way friction element, an isokinetic arm motion, and/or a speed controller.